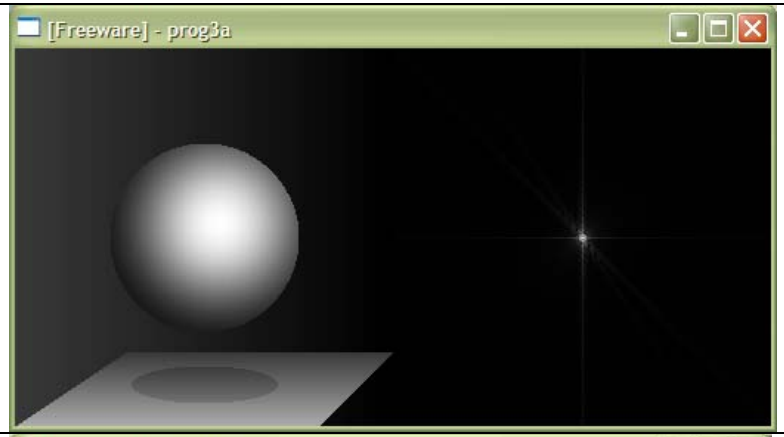
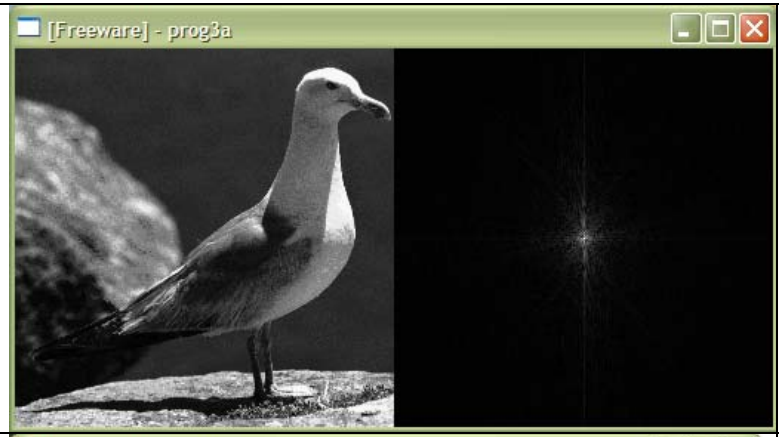
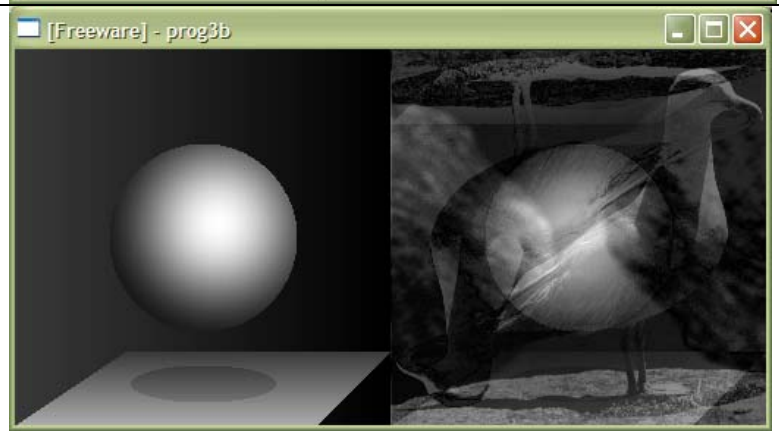
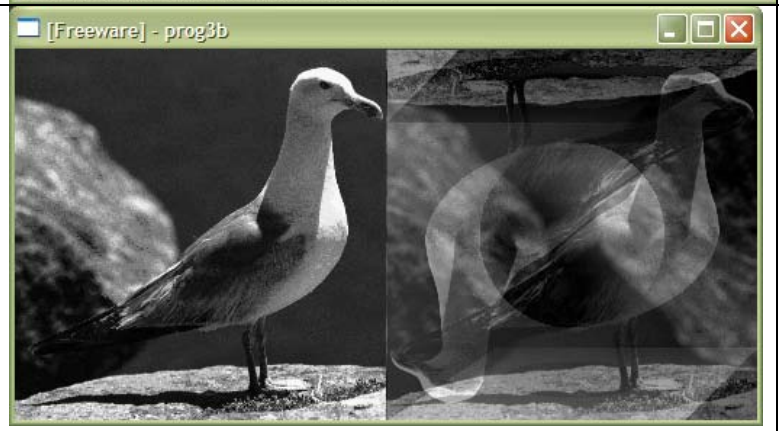
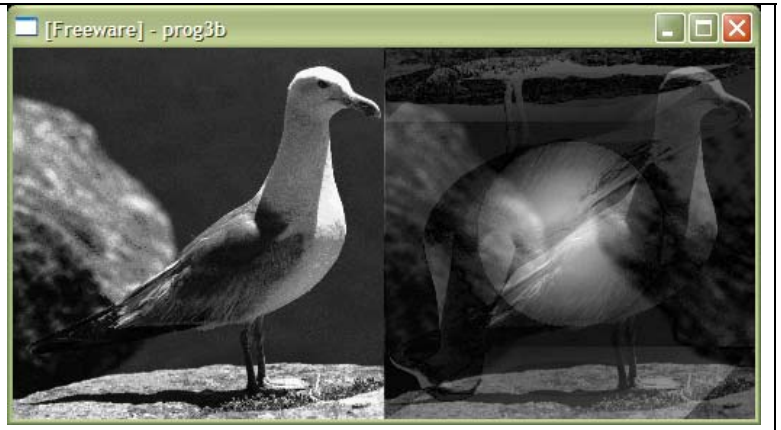
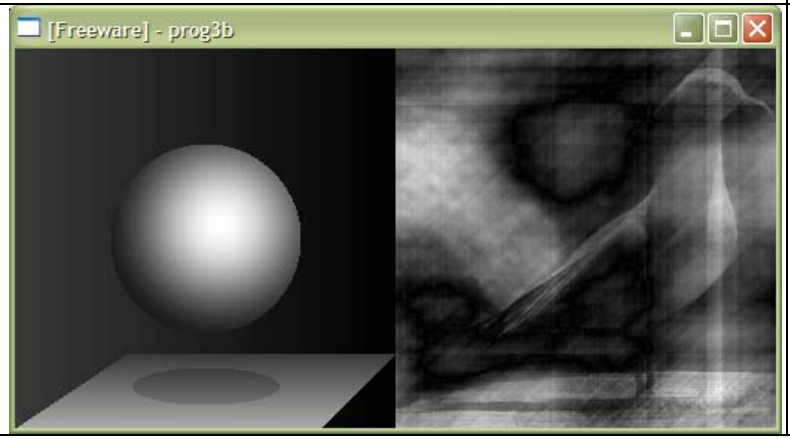
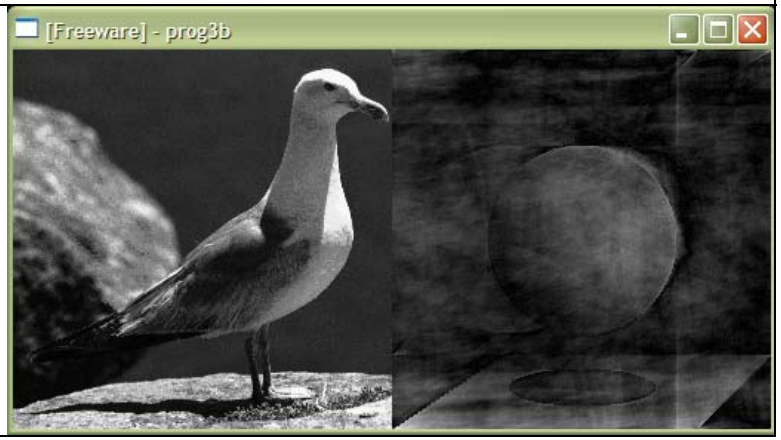
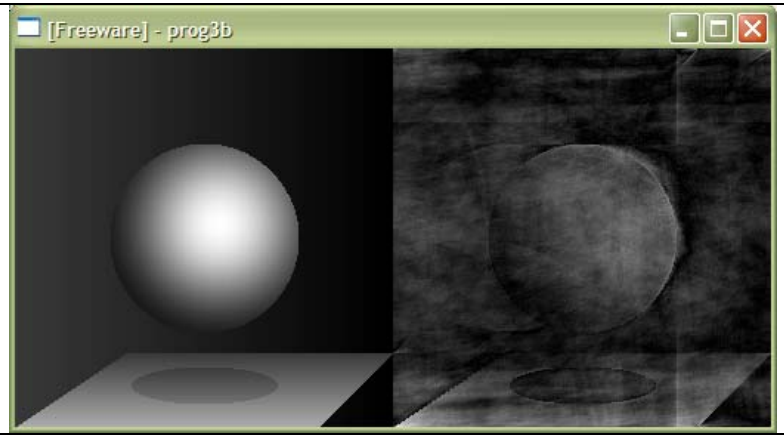
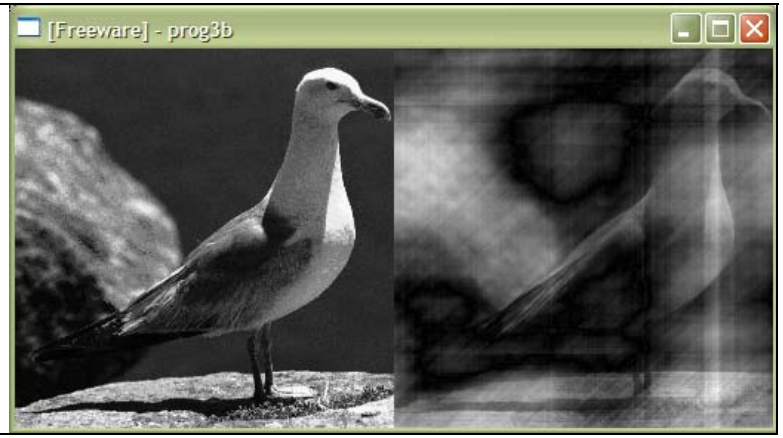
Image Analysis and Pattern Recognition

Program Assignment (HW3)

Solutions

(Part A) Figure 1 - The right side of each window displays the Discrete Fourier Transform of its image on the left.		
(Part B) Figure 2 - After Imaginary component swapping, the new image is displayed on the right side of the window.		

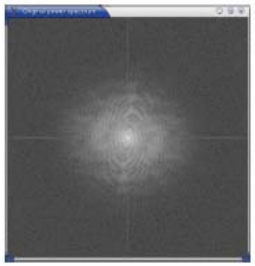
(Part B) Figure 3 - After the real component swapping, the new image is displayed on the right side of the window.		
(Part B) Figure 4 - After Phase Swapping		

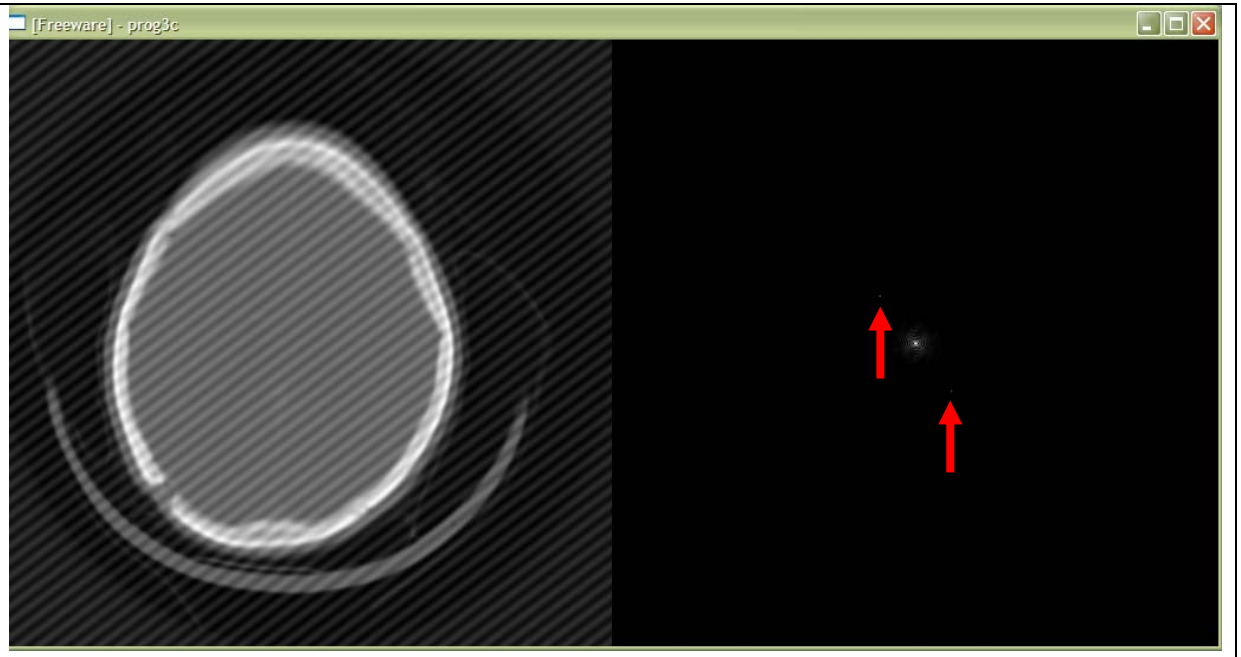
(Part B) Figure 5 - After Magnitude Swapping		

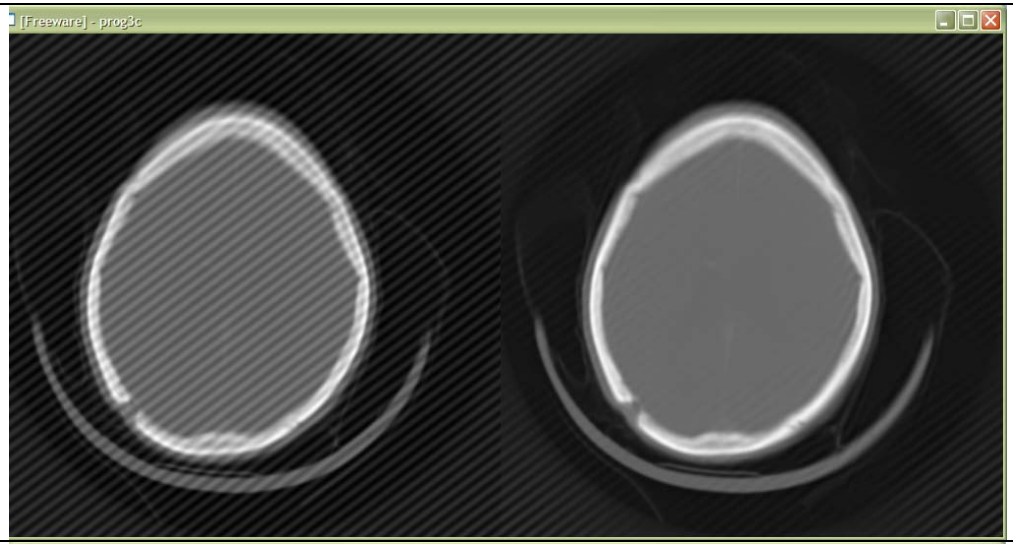
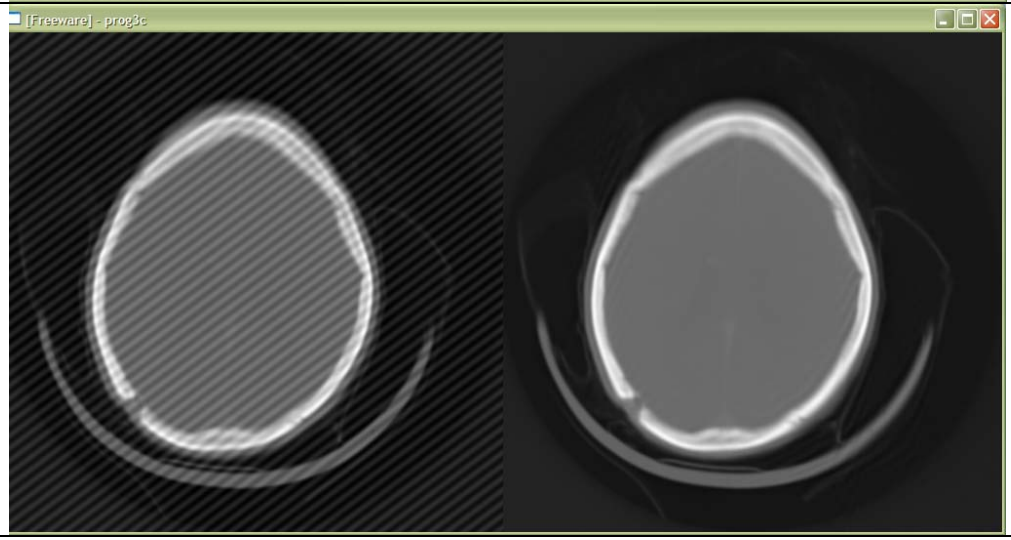
Conclusion:
From the DFT swapping experiment, it shows that “Phase” is more important for preserving the image information. By swapping the imaginary components of two FTs, it blends both the shape and gray level from the other image with those of the original image. By swapping the phase, both shapes of the images are swapped. Unlike swapping the phase, when we swap the magnitude, only the gray levels are changed. Obviously, “Phase” keeps most of the spatial positioning information of the image.

(Part C) Figure 6 - On the right side of the window shows two spikes in the power spectrum of the image (red arrows).

Note: it helps to plot the log of the power spectrum (shows more structure):





(Part C) Figure 7 - After manually locating the spikes, we approximate the position of those areas and replace each pixel of those spike area with the average magnitude of the 8 neighboring pixels.	
(Part C) Figure 8 - Instead of replacing the spike area with the average magnitude of the 8 neighboring pixels, we set the spike area to be 0 in the power spectrum, the result image is cleaner.	

Conclusion:
Using Fourier Transform to find spikes in the power spectrum of the frequency domain can effectively remove the periodic noise in the spatial domain and produce a cleaner image. A peak search algorithm could be developed to find the spikes automatically.